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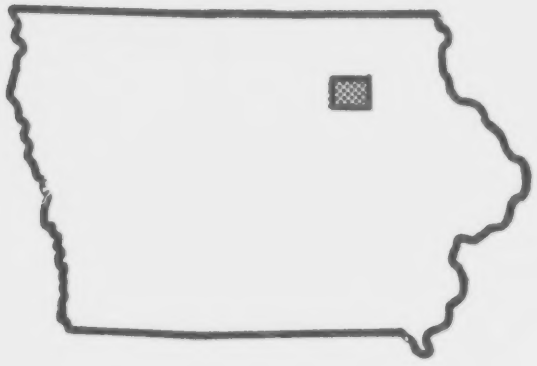
FLOOD INSURANCE STUDY

BREMER COUNTY, IOWA
AND INCORPORATED AREAS



COMMUNITY NAME	COMMUNITY NUMBER
DENVER, CITY OF	190026
FREDERIKA, CITY OF	190027
PLAINFIELD, CITY OF	190327
SUMNER, CITY OF	190029
TRIPOLI, CITY OF	190669
WAVERLY CITY OF	190030
UNINCORPORATED AREAS	190847

JULY 16, 1990

Federal Emergency Management Agency

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

BREMER COUNTY, IOWA,
AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the geographic area of Bremer County, Iowa, including the Cities of Denver, Sumner, Frederika, Plainfield, Tripoli, and Waverly, and the unincorporated areas of Bremer County (hereinafter referred to collectively as Bremer County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

This Flood Insurance Study revises and supersedes a previous Flood Insurance Rate Map for the City of Plainfield (Reference 1) and a Flood Insurance Study for the City of Waverly (Reference 2). This information will be used by the communities to update existing floodplain regulations as part of the regular phase of the National Flood Insurance Program. The information will also be used by local and regional planners to further promote sound land use and floodplain development.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by DeWild Grant Reckert and Associates Co., (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-86-C-2230. This study was completed in January 1988. The hydrologic and hydraulic analyses for Dry Run Creek and Unnamed Creek were obtained from the Flood Insurance Study for the City of Waverly, Iowa (Reference 2). The hydrologic and hydraulic analyses for the West Fork Cedar River were obtained from the Flood Insurance Study for Black Hawk County, Iowa (Reference 3).

1.3 Coordination

On October 23, 1985, an initial coordination meeting held at the Bremer County Courthouse in Waverly was attended by personnel representing the Study Contractor, FEMA, the Iowa Department of Natural Resources (IDNR), and public and private interests representing Bremer County and the Cities of Denver and Sumner. The purpose of the meeting was to select county base maps, identify streams that should be studied, initiate the data gathering and public input processes, and provide general information on the nature and impact of the Flood Insurance Program.

In September-October 1986, announcements of intent to perform a flood elevation study were published in the Bremer County Independent, the Denver Forum, the Sumner Gazette, and the Tripoli Leader.

During the course of study, coordination was maintained with Bremer County and the communities to ensure efficient and comprehensive data collection and analyses as well as proper floodplain and floodway delineation. Both the county and the communities provided a current base map and all other pertinent information which was available. In addition, the Bremer County Engineer's office provided copies of aerial photography and elevation reference mark data. The U.S. Geological Survey (USGS) furnished copies of applicable reports (References 4 and 5) as well as elevation reference mark data, flood prone area maps, and information on the gaging station on the Cedar River at Janesville. The National Geodetic Information Center furnished a copy of elevation reference mark data from their records. The U.S. Army Corps of Engineers (COE), Rock Island District, furnished a copy of their cross-section data and work map from their work on the Flood Insurance Study for Waverly (Reference 2).

On August 28, 1989, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the geographic area of Bremer County, Iowa. The area of study is shown on the Vicinity Map (Figure 1).

Flooding caused by overflow of the Cedar River, Quarter Section Run, the Little Wapsipinicon River, Dry Run Creek, the West Fork Cedar River, the East Fork Wapsipinicon River, the Wapsipinicon River and a tributary of the Cedar River called Unnamed Creek was studied in detail.

Areas having low development potential or minimal flood hazards were previously studied using approximate analyses. The results were shown on the Flood Hazard Boundary Maps for Bremer County, Iowa, and the Cities of Sumner, Denver, and Frederika (References 6-9) and the Flood Insurance Rate Map for the City of Waverly (Reference 2).

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

BREMER COUNTY, IA
AND INCORPORATED AREAS

APPROXIMATE SCALE

16 0 16 32 48 MILES

VICINITY MAP

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through January 1993. The scope and methods of study were proposed to and agreed upon by FEMA and Bremer County, Iowa.

2.2 Community Description

Bremer County is in northeastern Iowa, about 15 miles north of the Waterloo-Cedar Falls Metropolitan area. The county is bordered on the north by Chickasaw County, Iowa; on the south by Black Hawk County, Iowa; on the east by Fayette County, Iowa; and on the west by Butler County, Iowa. Major transportation routes that serve Bremer County include U.S. Highways 63 and 218, State Highways 3, 93, and 188, the Illinois Central Railroad, and the Chicago and North Western railroad. The 1980 population of Bremer County was reported to be 24,820 (Reference 10). The economy of Bremer County is predominantly agriculture and agricultural oriented industry and business.

The topography of Bremer County varies from gently sloping to rolling. The floodplains vary from narrow to moderately wide. All of Bremer County drains to either the Cedar River or the Wapsipinicon River watersheds. The floodplains in Bremer County are primarily used for agricultural or open land, with development occurring, especially in or near the communities within the county. Soils in Bremer County are not known to have any unusual characteristics that would have a substantial effect on flooding conditions.

The climate of Bremer County is subhumid midcontinental with an average annual precipitation of about 33 inches. An average of 70 percent of the year's total rain falls from April to September; areal distribution of rainfall is generally uniform, except for some summer thunderstorms that may be more intense in certain locales. The mean temperature is 49 degrees Fahrenheit (^{o}F), and the coldest and warmest months are January and July, with average temperatures of 17^{o}F and 72^{o}F, respectively (Reference 11).

2.3 Principal Flood Problems

The history of flooding in Bremer County indicates that flooding may occur during any non-winter month. Most floods have been in the spring or early summer as a result of heavy rainfall and/or snowmelt. However, locally heavy thunderstorms in late summer or autumn have also caused flooding.

In the past, damaging floods have occurred on the Cedar River, the most notable being the floods that occurred in 1945, 1961, and 1965. The flood in March 1961 is the largest flood within the 65-year record at the gaging station at Janesville. This flood has an estimated recurrence interval of 50 years.

The largest flood on the Wapsipinicon River and the East Fork Wapsipinicon River during the past 50 years was the flood in June 1969, which has a recurrence interval of about 50 years. The Little Wapsipinicon River near Sumner also experienced serious flooding in June 1969 and in August 1979. Quarter Section Run near the City of Denver experienced serious flooding in June 1969 and during 1974 after a very heavy rainfall in the area.

2.4 Flood Protection Measures

The levee located at the confluence of the East Fork Wapsipinicon and the Wapsipinicon River provides some protection to the Wildlife Management Area against low frequency floods. However, it does not provide protection against 100-year flooding. The exent of protection provided by the Sweet Marsh Dam on the East Fork Wapsipinicon River and another dam on the Wapsipinicon River is minimal and they would not provide complete protection to the county from a major event such as a 100-year flood.

Presently, no other significant flood protection or flood control structures exist that would substantially affect flooding conditions within Bremer County.

Nonstructural measures of flood protection in the form of land use regulations (Reference 12) are being utilized to aid in the prevention of future flood damage.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40-percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60-percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

The Flood Insurance Study published for Black Hawk County, Iowa (Reference 3) was based on peak flood discharge estimates for the Cedar River determined from the gaging station record at Janesville. A new statistical analysis of the gaging station record for the 65 years of record now available was conducted during this study in accordance with Bulletin No. 17B (Reference 13). Based on this analysis, the peak discharge estimate for the 100-year flood was found to be about 12 percent lower than that in the previous Black Hawk County report. After coordination with the IDNR and FEMA, the decision was made to utilize the current estimates for the Cedar River. Discharges at other locations along the Cedar River within the county were derived from a correlation of discharge versus drainage area.

No flow records are available for Dry Run Creek and the Unnamed Creek. The mean annual flood and standard deviation for these tributaries were computed using the Region I equation of Iowa Natural Resources Council Bulletin No. 12 (Reference 14). Using these values and a skew coefficient of -0.4, the frequency curves were calculated along with the 0.05 and 0.95 limit curves using U.S. Water Resources Council Bulletin No. 17 (Reference 15).

The other streams studied in detail do not have gaging stations in the near proximity where flood discharge estimates are required. Therefore, estimates for these streams were derived from the Model 2 regression equations for Region I that are published in Bulletin No. 11 (Reference 16). The slopes and discharge areas of the respective watersheds that were used in the regression equations were derived from Bulletin No. 7 (Reference 17), and from topographic maps (Reference 18).

Peak discharge-drainage area relationships for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CEDAR RIVER					
just above confluence of Quarter Section Run	1,567	23,400	34,700	39,000	48,400
at Bremer Avenue Dam	1,549	23,200	34,400	38,600	47,900
at County Highway C33	1,534	23,000	34,100	38,200	47,500
just above confluence of Twomile Creek	1,468	22,400	33,000	36,700	45,500
at north county boundary	1,443	22,100	32,500	36,200	44,800

TABLE 1 - SUMMARY OF DISCHARGES (Continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQ MILES)	PEAK DISCHARGE (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
WAPSIPINICON RIVER					
at south county boundary	544	12,500	20,300	23,800	31,500
at State Highway 3	525	12,400	20,100	23,600	31,300
just above confluence of the East Fork Wapsipinicon River	345	9,900	16,400	19,400	26,300
EAST FORK WAPSIPINICON RIVER					
at mouth	148	6,300	10,900	13,200	18,500
about 1.2 miles upstream of State Highway 93	134	6,000	10,500	12,600	17,800
LITTLE WAPSIPINICON RIVER					
about 1.0 mile downstream of Division Street	49.5	3,780	6,850	8,380	12,250
at Division Street	42.9	3,490	6,380	7,830	11,530
at Walnut Street	42.0	3,460	6,330	7,780	11,450
at eastern county boundary	41.4	3,450	6,300	7,740	11,410
QUARTER SECTION RUN					
about 1.5 miles downstream of Fayette Street	37.5	3,020	5,620	6,970	10,440
at County Highway C50	35.2	2,870	5,380	6,680	10,070
at U.S. Highway 63	34.4	2,830	5,310	6,600	9,960
WEST FORK CEDAR RIVER					
upstream of confluence of the Shell Rock River	855	19,100	30,650	35,650	47,000
DRY RUN CREEK					
at mouth	2.65	780	1,370	1,628	2,315
UNNAMED CREEK					
at mouth	4.56	1,180	2,000	2,300	3,150

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Channel and valley cross sections for the backwater analyses were based on field surveys. Valley cross sections for the Cedar River were derived from aerial photography by photogrammetric means. Elevation data and structural geometry of all bridges, dams, or culverts were obtained either from construction drawings or field surveys. Some of the channel and valley cross sections on the Cedar River were taken from previous studies (Reference 2).

The cross sections shown for Dry Run Creek were obtained as part of an unpublished feasibility study for flood control in the Iowa-Cedar River basin in 1967 (Reference 19). The cross sections shown for the Cedar River and Unnamed Creek were field surveyed. All bridges were surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles and on the Flood Insurance Rate Map.

Water-surface elevations of floods of the selected recurrence intervals were computed using the HEC-2 step-backwater computer program (Reference 20).

Starting water-surface elevations for the Cedar River were derived from elevation-discharge curves based on the discharges and flood profiles published in the Flood Insurance Study for Black Hawk County (Reference 3). Starting water-surface elevations for Quarter Section Run and the Little Wapsipinicon River were computed using the slope-area method. The starting water-surface elevations for the West Fork Cedar River were taken at the same frequency of the Cedar River at the confluence point.

Water-surface elevations for the Wapsipinicon River, the East Fork Wapsipinicon River, and the upper portion of the Cedar River were extrapolated from high water marks taken from historical data.

Dry Run Creek and Unnamed Creek starting water-surface elevations were determined from the Cedar River 10-year flood elevations at their confluence points. Water-surface elevations were computed using the COE HEC-2 step-backwater computer program (Reference 21).

Roughness coefficients (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and floodplain areas in addition to aerial photographs of the detailed study areas. Roughness values for the main channel of all streams, excluding the West Fork Cedar River, studied in detail range from 0.035 to 0.045 with floodplain roughness values ranging from 0.07 to 0.095 for all floods. The suitability of all hydraulic factors, cross sections, and hydraulic structure data used in the computer models for the Cedar River were evaluated by comparison with the 1961 flood profile (Reference 4). Dry Run Creek and

Creek and Unnamed Creek roughness factors were determined by inspection of aerial photographs of the area (Reference 22). The value used for Dry Run Creek was 0.04 in the channel and 0.085 in the overbank and for Unnamed Creek 0.045 in the channel and from 0.040 to 0.045 in the overbank.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. In cases where the 50- and 100-year flood elevations are close together, due to limitations of the profile scale, only the 100-year profile has been shown.

The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet (Reference 18).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE) and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary was delineated using the Flood Insurance Rate Map for the City of Waverly (Reference 2) and the Flood Hazard Boundary Maps for Bremer County and the Cities of Sumner, Denver and Frederika (References 6-9). Flood prone area maps (Reference 23) and topographic maps (Reference 18) were also used.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways for this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections and are shown in Table 2, Floodway Data. The computed floodways are shown on the Flood Insurance Rate Map. In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

Along streams where floodways have not been computed, the community must ensure that the cumulative effect of development in the floodplain will not cause more than 1.0-foot increase in the base flood elevations at any point within the community.

The area between the floodway and the 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
CEDAR RIVER								
A	219.33	325	4668	8.8	883.9	883.9	884.7	0.8
B	219.42	328	4872	8.4	884.8	884.8	885.5	0.7
C	219.52	430	6771	6.1	886.2	886.2	886.7	0.5
D	219.74	508	7201	5.7	887.0	887.0	887.4	0.4
E	220.03	670	9481	4.3	888.3	888.3	888.7	0.4
F	220.62	420	7566	5.4	889.3	889.3	889.8	0.5
G	221.89	1100	14,834	2.8	891.5	891.5	892.2	0.7
H	222.76	1650	17,935	2.3	892.8	892.8	893.6	0.8
I	223.37	930	10,559	3.9	893.8	893.8	894.6	0.8
J	223.90	1749	17,227	2.4	895.2	895.2	896.1	0.9
K	224.35	2180	19,210	2.1	895.9	895.9	896.8	0.9
L	225.06	1200	13,746	3.0	897.0	897.0	897.9	0.9
M	225.65	440	6980	5.6	898.6	898.6	899.5	0.9
N	226.12	1340	15,682	2.5	900.0	900.0	901.0	1.0
O	226.47	560	9028	4.3	900.4	900.4	901.4	1.0
P	227.14	780	10,374	3.8	901.8	901.8	902.8	1.0
Q	227.73	361	7054	5.5	902.9	902.9	903.9	1.0
R	228.10	900	5936	6.5	903.8	903.8	904.7	0.9
S	228.41	900	7384	5.2	905.0	905.0	906.0	1.0
T	228.59	710	7066	5.5	905.6	905.6	906.5	0.9
U	228.93	1000	9861	3.9	906.5	906.5	907.4	0.9
V	229.16	700	8663	4.5	906.7	906.7	907.7	1.0
W	229.38	700	10,492	3.7	907.3	907.3	908.2	0.9
X	229.82	950	12,866	3.0	908.0	908.0	908.9	0.9
Y	230.07	470	8336	4.6	908.6	908.6	909.5	0.9
Z	230.26	550	9216	4.2	909.0	909.0	909.8	0.8

[1]MILES ABOVE MOUTH

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BREMER COUNTY, IA AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
CEDAR RIVER								
AA	230.52	346	5709	6.8	909.5	909.5	910.3	0.8
AB	230.67	510	8259	4.7	915.2	915.2	915.3	0.1
AC	230.90	960	13,972	2.8	915.9	915.9	916.2	0.3
AD	231.00	1028	15,652	2.5	916.0	916.0	916.3	0.3
AE	231.18	1130	16,295	2.4	916.1	916.1	916.4	0.3
AF	231.56	1050	11,610	3.3	916.4	916.4	916.6	0.2
AG	232.09	605	9253	4.2	917.3	917.3	917.8	0.5
AH	232.41	1250	14,655	2.6	917.7	917.7	918.4	0.7
AI	232.70	1150	13,400	2.9	917.9	917.9	918.6	0.7
AJ	233.02	1300	18,936	2.0	918.5	918.5	919.1	0.6
AK	233.87	1710	20,874	1.8	919.1	919.1	919.8	0.7
AL	234.26	1650	18,437	2.1	919.7	919.7	920.4	0.7
AM	235.11	1790	19,746	2.0	920.9	920.9	921.7	0.8
AN	236.33	1190	13,638	2.8	922.8	922.8	923.7	0.9
AO	236.56	1170	13,197	2.9	923.4	923.4	924.3	0.9
AP	236.91	369	5691	6.7	924.1	924.1	925.0	0.9
AQ	237.05	990	13,693	2.8	925.3	925.3	925.9	0.6

[1]MILES ABOVE MOUTH

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BREMER COUNTY, IA AND INCORPORATED AREAS

FLOODWAY DATA

CEDAR RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
LITTLE WAPSIPINICON RIVER								
A	9400	800	4100	2.0	1048.4	1048.4	1049.3	0.9
B	11,560	520	2897	2.9	1050.3	1050.3	1051.2	0.9
C	13,880	525	3652	2.3	1052.4	1052.4	1053.4	1.0
D	15,020	165	1302	6.0	1053.5	1053.5	1054.4	0.9
E	16,100	870	5842	1.3	1055.0	1055.0	1055.6	0.6
F	17,240	780	4246	1.8	1055.4	1055.4	1056.1	0.7
G	18,080	198	1347	5.8	1056.0	1056.0	1056.8	0.8
H	19,540	685	3696	2.1	1058.2	1058.2	1058.8	0.6
I	20,880	440	2631	3.0	1059.2	1059.2	1060.0	0.8
J	21,760	141	1613	4.8	1059.8	1059.8	1060.6	0.8
DRY RUN CREEK								
A	150[2]	210	2300	0.91	908.9	905.0[3]	906.0	1.0
B	855[2]	230	1144	1.83	908.9	907.0[3]	907.4	0.4
C	1545[2]	130	709	2.30	910.4	910.4	910.5	0.1
D	1955[2]	130	478	3.40	910.6	910.6	910.8	0.2
E	2710[2]	230	810	2.00	911.7	911.7	912.5	0.8
F	3300[2]	270	859	1.89	913.1	913.1	913.7	0.6
G	4260[2]	210	584	2.79	914.6	914.6	915.0	0.4
H	4570[2]	240	1025	1.59	914.9	914.9	915.7	0.8
I	4950[2]	250	886	1.84	915.1	915.1	915.9	0.8
J	5340[2]	250	974	1.67	915.2	915.2	916.2	1.0
K	6000[2]	340	1205	1.35	915.6	915.6	916.6	1.0
L	6200[2]	300	1138	1.43	915.8	915.8	916.8	1.0
M	6775[2]	313	890	1.83	916.1	916.1	917.1	1.0
N	7397[2]	233	638	2.55	917.3	917.3	917.6	0.3
O	7967[2]	250	343	4.75	918.6	918.6	918.9	0.3

[1]FEET ABOVE COUNTY HIGHWAY C28
[2]FEET ABOVE MOUTH
[3]ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM CEDAR RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BREMER COUNTY, IA AND INCORPORATED AREAS

FLOODWAY DATA

LITTLE WAPSIPINICON RIVER—DRY RUN CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
UNNAMED CREEK								
A	120	137	2105	1.09	907.8	903.8[3]	904.8	1.0
B	1600	150	946	2.43	907.8	903.8[3]	904.8	1.0
QUARTER SECTION RUN								
A	13,400[2]	420	2732	2.6	928.2	928.2	929.0	0.8
B	15,760[2]	350	1840	3.8	930.9	930.9	931.7	0.8
C	16,800[2]	340	2316	3.0	932.7	932.7	933.6	0.9
D	17,548[2]	126	1197	5.8	933.5	933.5	934.3	0.8
E	17,788[2]	400	3112	2.2	934.4	934.4	935.0	0.6
F	19,668[2]	460	3051	2.3	935.4	935.4	936.1	0.7
G	23,988[2]	535	2613	2.7	939.1	939.1	939.8	0.7
H	25,888[2]	465	4162	1.6	943.5	943.5	944.1	0.6
I	26,748[2]	590	4520	1.5	943.7	943.7	944.3	0.6
J	27,708[2]	128	1231	5.4	943.9	943.9	944.6	0.7
K	28,198[2]	440	3290	2.0	944.7	944.7	945.3	0.6
L	28,668[2]	440	3379	2.0	945.3	945.3	946.1	0.8
M	30,448[2]	535	3394	1.9	946.1	946.1	946.9	0.8

[1]FEET ABOVE MOUTH
[2]FEET ABOVE COUNTY HIGHWAY C50 (DOWNSTREAM CROSSING)
[3]ELEVATIONS WITHOUT CONSIDERING BACKWATER EFFECT FROM CEDAR RIVER

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

BREMER COUNTY, IA AND INCORPORATED AREAS

FLOODWAY DATA

UNNAMED CREEK—QUARTER SECTION RUN

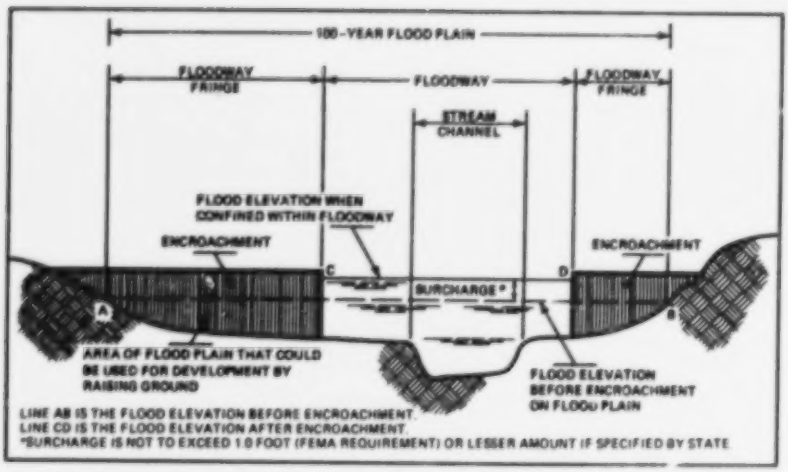
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 2 - Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The current Flood Insurance Rate Map presents flooding information for the geographic area of Bremer County. Previously, separate Flood Hazard Boundary Maps and/or Flood Insurance Rate Maps were prepared for each flood-prone incorporated community and the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in Table 3, Community Map History.

7.0 OTHER STUDIES

The flood elevations, flood boundaries, and floodways presented in this report do not match those presented in Black Hawk County study (Reference 3) due to lower flood discharges used for the Cedar River in this study.

This Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Map for Bremer County, Iowa, and the Cities of Sumner, Denver, and Frederika (References 6-9) the previously printed Flood Insurance Rate Map for the City of Plainfield (Reference 1) and the previously published Flood Insurance Study for the City of Waverly (Reference 2).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Old Federal Office Building, Room 300, 911 Walnut Street, Kansas City, Missouri 64106.

Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the map repository of flood hazard data located in the community.

9.0 REFERENCES AND BIBLIOGRAPHY

1. Federal Emergency Management Agency, Flood Insurance Rate Map, City of Plainfield, Bremer County, Iowa, March 1986.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
DENVER, CITY OF	MARCH 22, 1974	FEBRUARY 27, 1976	JULY 16, 1990	
FREDERIKA, CITY OF	NOVEMBER 22, 1974		JULY 16, 1990	
PLAINFIELD, CITY OF	NOVEMBER 5, 1976		MARCH 1, 1986	
SUMNER, CITY OF	MAY 3, 1974	APRIL 30, 1976	JULY 16, 1990	
TRIPOLI, CITY OF	MARCH 26, 1976		JULY 16, 1990	
WAVERLY, CITY OF	MARCH 29, 1974	APRIL 30, 1976	MARCH 2, 1981	
UNINCORPORATED AREAS	MAY 10, 1977		JULY 16, 1990	

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

BREMER COUNTY, IA AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

2. ————, Federal Insurance Administration, Flood Insurance Study, City of Waverly, Bremer County, Iowa, September 1980.

3. ————, Flood Insurance Study, Black Hawk County, Unincorporated Areas, Iowa, May 1982.

4. U.S. Geological Survey, Water Resources Investigations, Cedar River Basin Floods, in cooperation with the Iowa State Highway Commission, Bulletin No. 27, Iowa Highway Research Board, Harlan H. Schwob, June 1963.

5. ————, Floods in the Wapsipinicon River Basin, Iowa, in cooperation with the Iowa State Highway Commission, Open-File Report, Harlan H. Schwob, February 1971.

6. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, Bremer County, Unincorporated Areas, Iowa, May 1977.

7. ————, Federal Insurance Administration, Flood Hazard Boundary Map, City of Sumner, Bremer County, Iowa, April 1976.

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10. U.S. Department of Commerce, Bureau of the Census, 1980 Census of Population, Number of Inhabitants, Iowa, Washington, D.C., February 1982.

11. ————, National Oceanic and Atmospheric Administration, Environmental Data Services, Climatological Data for Iowa, Asheville, North Carolina, 1976.

12. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Code of Federal Regulations, Title 24, Chapter 10, Parts 1910-3A and 3B, Federal Register, Volume 41, No. 207, Revision 1976.

13. U.S. Department of the Interior, Geological Survey, Interagency Advisory Committee on Water Data, Office of Water Data Coordination, Hydrology Subcommittee, Bulletin No. 17B, Guidelines for Determining Flood Flow Frequency, September 1981, revised March 1982.

14. Iowa Natural Resources Council, Bulletin No. 12, "Floods in Iowa, a Comparative Study of Regional Flood Frequency Methods," U.S. Geological Survey, December 1974.

15. U.S. Water Resources Council, Bulletin No. 17, Guidelines for Determining Flood Flow Frequency, March 1976.

16. U.S. Geological Survey, Floods in Iowa: Technical Manual for Estimating Their Magnitude and Frequency, Iowa Natural Resources Council Bulletin No. 11, Oscar G. Lara, March 1973.

17. ————, Water Resources Division, Drainage Areas of Iowa Streams, in cooperation with the Iowa State Highway Commission, Bulletin No. 7, Iowa Highway Research Board, O.J. Larimer, December 1957.

18. ----------, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 Feet: Alpha, 1971; Bremer, 1971; Denver, 1963, photorevised 1972; Fairbank, 1971; Fredericksburg, 1971; Fredericka, 1971; Nashua, 1971; Plainfield, 1971; Readlyn, 1971; Shell Rock, 1971; Sumner, 1971; Sumner SW, 1971; Tripoli, 1971; Tripoli NW, 1971; Waverly, 1963, photorevised 1972.

19. U.S. Army Corps of Engineers, Rock Island District, Unpublished Feasibility Study for Flood Control in the Iowa Cedar Basin, Waverly, Iowa, 1967.

20. U.S. Army Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Computer Program 723-X6-L202A, Davis, California, April 1984.

21. ————, Hydrologic Engineering Center, HEC-2 Water Surface Profiles, Davis, California, version updated 1976.

22. Aero-Metric Engineering, Inc., Aerial Topography Maps, Scale 1:24000, Contour Interval 2 Feet: Waverly, Iowa, May 1978.

23. U.S. Geological Survey, Water Resources Division, Flood Prone Area Maps: Alpha, 1974; Denver, 1973; Fairbank, 1974; Fredericksburg, 1974; Plainfield, 1976; Readlyn, 1974; Shell Rock, 1976; Sumner, 1974; Sumner SW, 1974; Waverly, 1969.

Chow, Ven Te, Handbook of Applied Hydrology, New York: McGraw-Hill Book Company, Inc., 1964.

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Dougal, Merwin D., et. al., Flood Plain Management, Iowa's Experience, Papers Presented to the Sixth Water Resources Design Conference, Iowa State University, 1969.

King, H.W. and E.F. Brater, King's Handbook of Hydraulics, 5th Edition, McGraw-Hill Book Company, Inc., 1963.

U.S. Department of Agriculture, Soil Conservation Service, National Engineering Handbook, Section 4, "Hydrology," 1972.

U.S. Geological Survey, Iowa Natural Resources Council Bulletin No. 12, Floods in Iowa: A Comprehensive Study of Regional Flood Frequency Methods, Oscar G. Lara, December 1974.

ELEVATION REFERENCE MARKS

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
1	0070	961.52	50d spike in transformer pole located north of 90 degree bend in road near northwest corner of Section 19 at R1N and T91N
2	0070	915.62	railroad spike in transformer pole on east side of gravel road located 4,500 feet north of County Highway C50, about 1.0 mile west of County Highway V19
3	0070	920.57	50d spike in power pole at southeast corner of 90 degree bend located 0.5 mile west of County Highway V19, about 1.5 miles north of County Highway C50
4	0025	926.69	chiseled cross on top of northwest end of west headwall of concrete box culvert located 800 feet south of crossing of county gravel road and Illinois Central Railroad
5	0025	934.65	pole spike and collar near ground level in south side of pole located on north side of road near farm house 1 mile east of U.S. Highway 218, about 2 miles south of State Highway 188
6	0025	940.66	chiseled square in center of east headwall of concrete box culvert under U.S. Highway 218 located 1 mile south of State Highway 188
7	0025	958.098	standard U.S. Coast and Geodetic Survey disk stamped "Q39 1934" set in top of concrete post projecting 6-inches above ground located 46 feet east of east rail of Illinois Central Railroad, about 155 feet east of centerline of U.S. Highway 218, about 4.3 miles north along the Illinois Central Railroad from station at Plainfield

ELEVATION REFERENCE MARKS (Continued)

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
8	0034	1,061.77	chiseled square on top of wingwall at southeast corner of Division Street bridge over the Little Wapsipinicon River, east about 1,800 feet south of State Highway 93
9	0034	1,063.73	chiseled square on northwest wingwall of Walnut Street bridge over the Little Wapsipinicon River
10	0042	1,047.95	chiseled cross on northeast corner of county road bridge abutment over the Little Wapsipinicon River located about 1,250 feet west of southeast corner of Section 26 at R11W and T93N
11	0050	998.51	chiseled square on west bank downstream wingwall of County Highway C28 bridge over the Wapsipinicon River, about 1.2 miles east of Tripoli
12	0050	1,005.68	chiseled square on west bank downstream abutment of State Highway 93 bridge over the Wapsipinicon River located 2 miles north of Tripoli
13	0050	1,054.72	chiseled square on east bank upstream headwall of concrete culvert on County Highway V5C located 3.75 miles north of Tripoli
14	0050	1,026.95	chiseled square on end wingwall of east upstream corner of County Highway C16 bridge over the Wapsipinicon River located about 1,300 feet south of Frederika
15	0050	1,026.05	chiseled cross on center of downstream headwall of 8-foot box culvert under east-west portion of U.S. Highway 63, about 1,300 feet west of curve in road, 1.75 miles north of Frederika
16	0050	1,003.65	chiseled square at upstream side beside valve housing at Sweet Marsh Levee

ELEVATION REFERENCE MARKS (Continued)

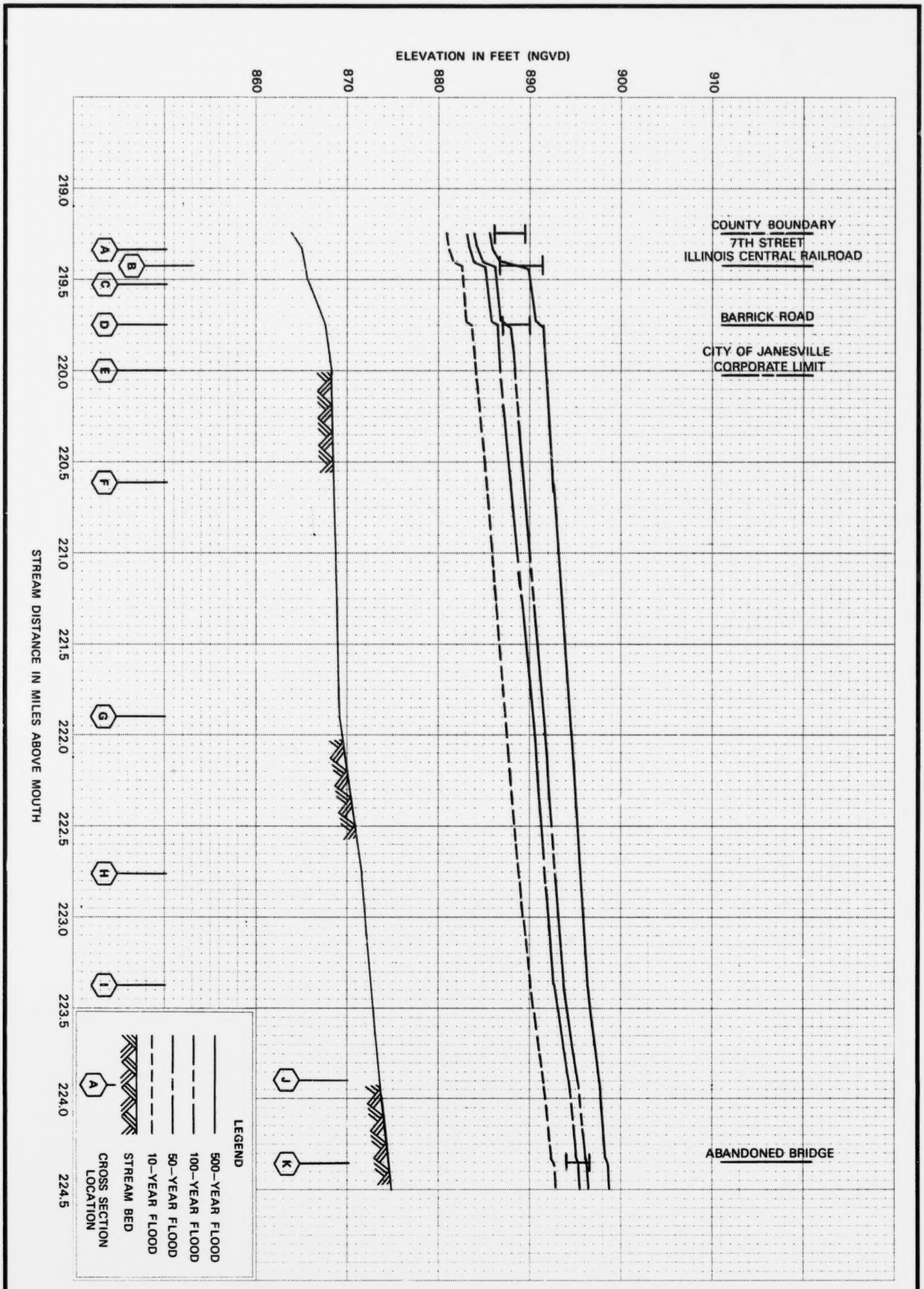
REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
17	0050	1,011.80	chiseled square on west bank downstream wingwall of State Highway 93 bridge over the East Fork Wapsipinicon River, about 1 mile east of junction of State Highway 93 and County Highway V5C, 2.5 miles northeast of Tripoli
18	0050	1,012.50	pole spike and collar in downstream wingpile east corner of County Highway C16 bridge over the East Fork Wapsipinicon River located 3.75 miles southeast of Frederika
19	0050	1,035.72	chiseled arrow on downstream guardrail at 18th post from east downstream corner of County Line Road bridge over the East Fork Wapsipinicon River
20	0054	951.46	chiseled cross on west tip of median strip located at intersection of 12th Street Northwest and Ridgewood Boulevard
21	0054	926.01	chiseled cross located on northeast corner of Horton Road bridge over the Cedar River
22	0054	921.24	chiseled square on top of southwest concrete cap of masonry wingwall located on Chicago and North Western railroad bridge over the Cedar River
23	0054	918.52	standard disk stamped "Waverly 1934" set in top of concrete post located at southwest corner of intersection of 3rd Street Southeast and 1st Avenue Northeast
24	0054	915.69	chiseled square on top streamward corner of concrete retaining wall located at northwest corner of Bremer Avenue bridge over the Cedar River

ELEVATION REFERENCE MARKS (Continued)

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
25	0054	961.90	chiseled cross on top of concrete culvert located at northeast corner of intersection of West Bremer Avenue and Twentieth Street Northwest
26	0055	918.46	chiseled square on top west end of north culvert of second pair of twin pipe culverts located about 4,400 feet north of Ridgewood along Twelfth Street Northwest
27	0055	935.13	top of bolt on top of east headwall of box culvert, about 150 feet south of Illinois Central Railroad crossing County Highway T77
28	0055	931.77	chiseled square around 0.75-inch metal plug embedded 3.7 feet east of west end of south bridge curb of County Highway C33 bridge over the Cedar River
29	0055	970.47	railroad spike in transmission pole No. 375 located at northeast corner of intersection of County Highway C33 and County Highway T76
30	0065	889.38	60d spike in east side of power pole located at southwest corner of intersection of Barrick Road and U.S. Highway 218
31	0065	919.43	railroad spike in transformer pole located on west side of north-south gravel road, about 2,600 feet north of intersection with Barrick Road in southeast corner of Section 26 and R14W and T91N
32	0065	907.88	chiseled cross on east end of south 54-inch pipe culvert on east side of intersection of U.S. Highway 218 and gravel road located about 1.5 miles north from Barrick Road along U.S. Highway 218

ELEVATION REFERENCE MARKS (Continued)

REFERENCE MARK	FLOOD INSURANCE RATE MAP PANEL	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
33	0065	903.94	pole spike and collar near ground level on road side of transformer pole located on southeast riverward side of tee intersection along the Cedar River
34	0067	950.46	chiseled square on top of wingwall at northwest corner of U.S. Highway 63 bridge over Quarter Section Run
35	0069	937.96	chiseled cross on headwall of box culvert on east side of U.S. Highway 63, located about 9 miles south of County Highway 50
36	0069	949.45	head of arrow below operating nut of fire hydrant located on southeast corner of intersection of State Street and Fayette Street
37	0100	977.38	chiseled square on right upstream wingwall of small concrete bridge located 2.3 miles east of County Highway V49, about 1.0 mile south of County Highway C50
38	0100	967.73	1.5-inch disk in east downstream corner of County Highway C50 bridge over the Wapsipinicon River
39	0100	975.34	pole spike and collar in west downstream abutment pile cap of Chicago and North Western railroad bridge over the Wapsipinicon River
40	0100	977.08	Iowa Highway Commission disk in east upstream abutment of State Highway 3 bridge over the Wapsipinicon River
41	0100	971.63	pole spike and collar in east upstream abutment pile cap of wooden bridge along County Highway C38, located 2 miles east of County Highway V49



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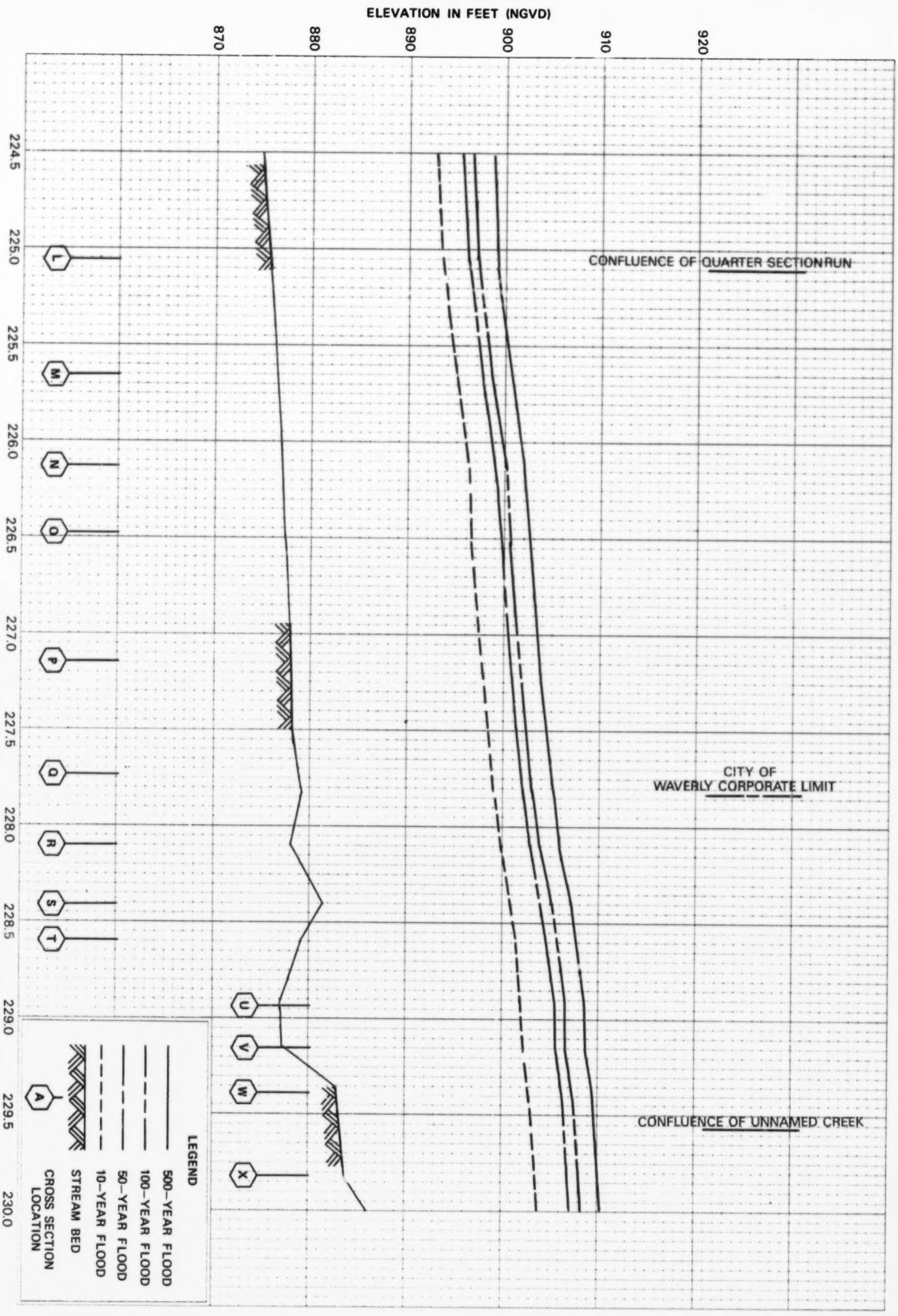

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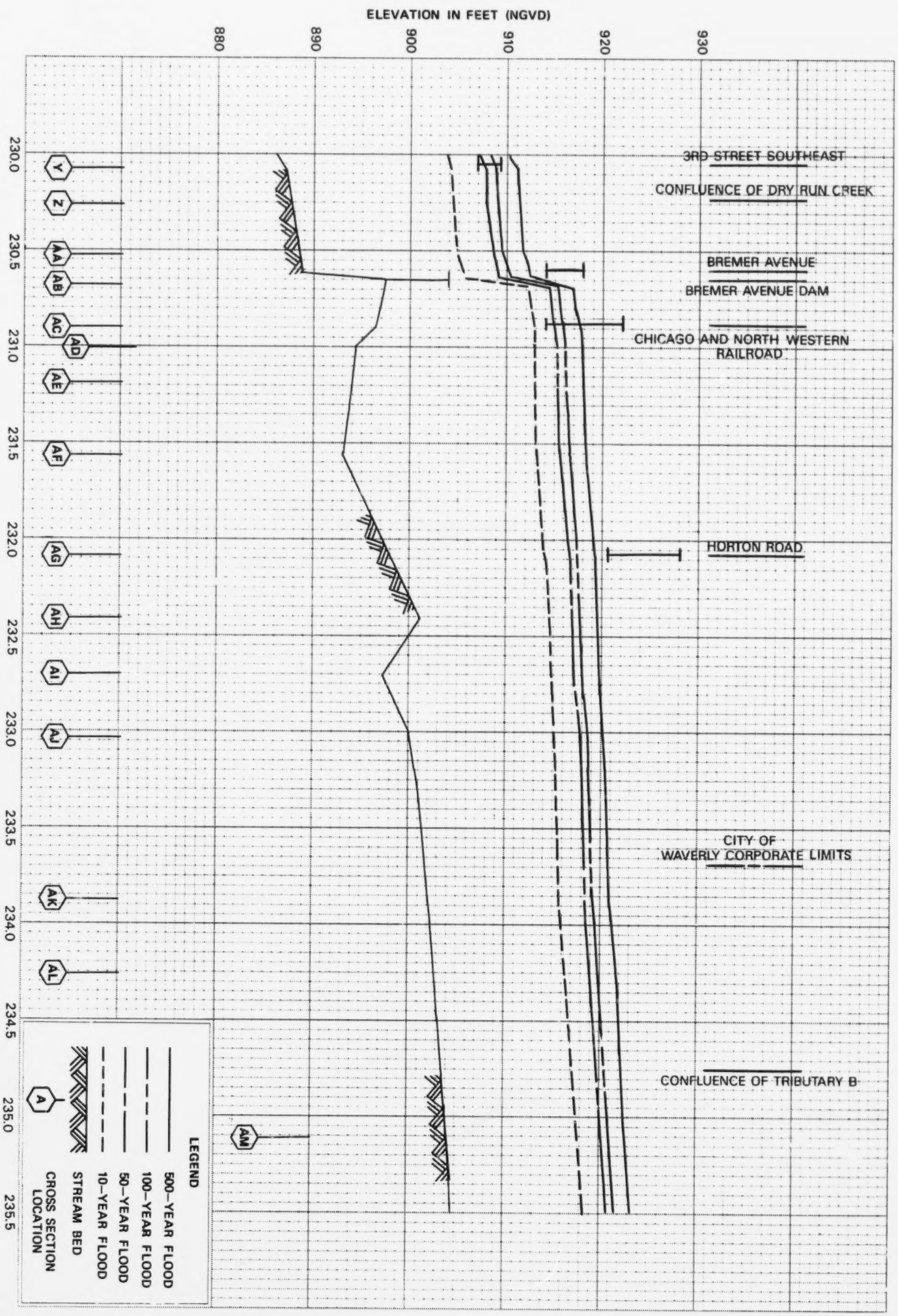

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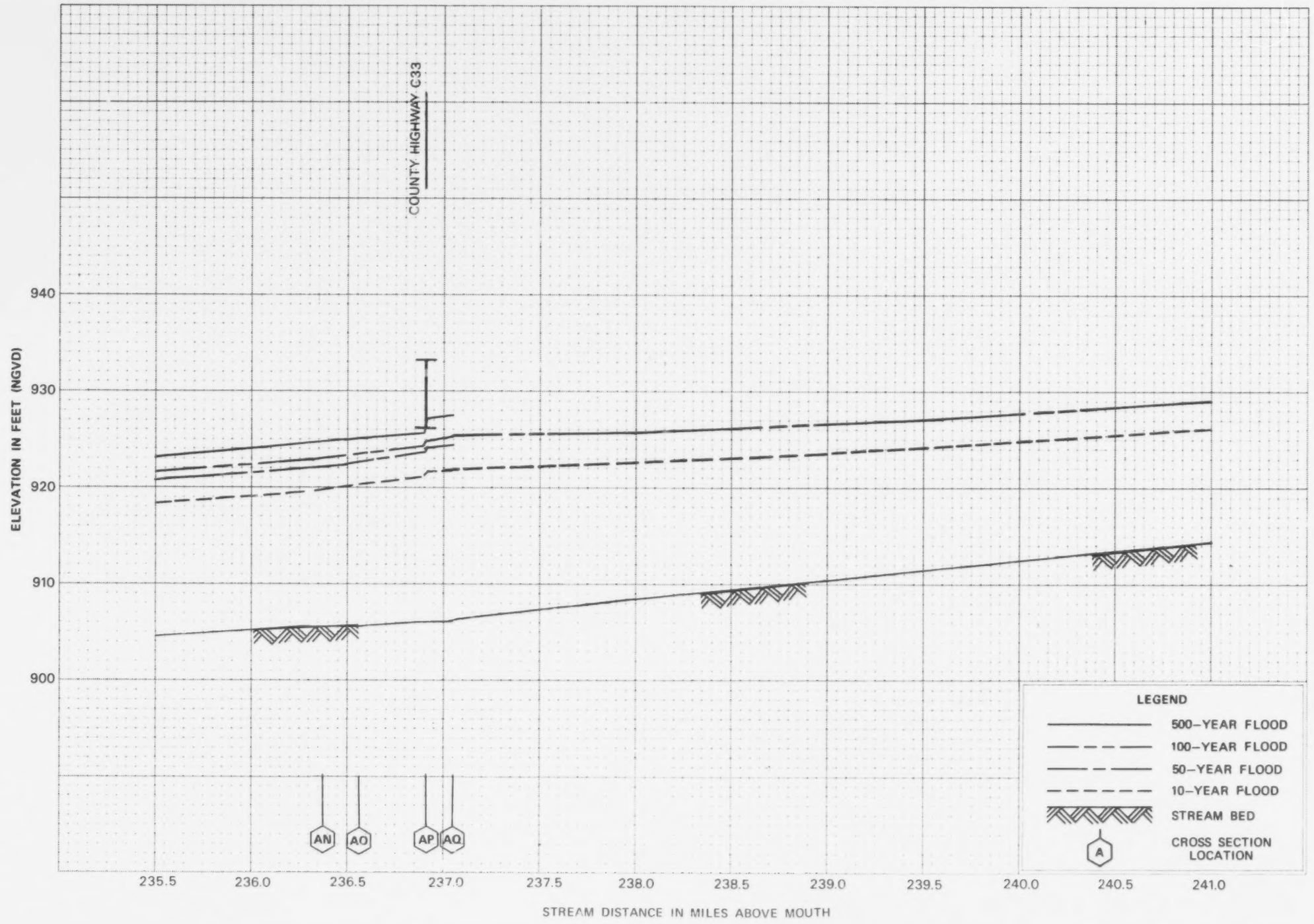


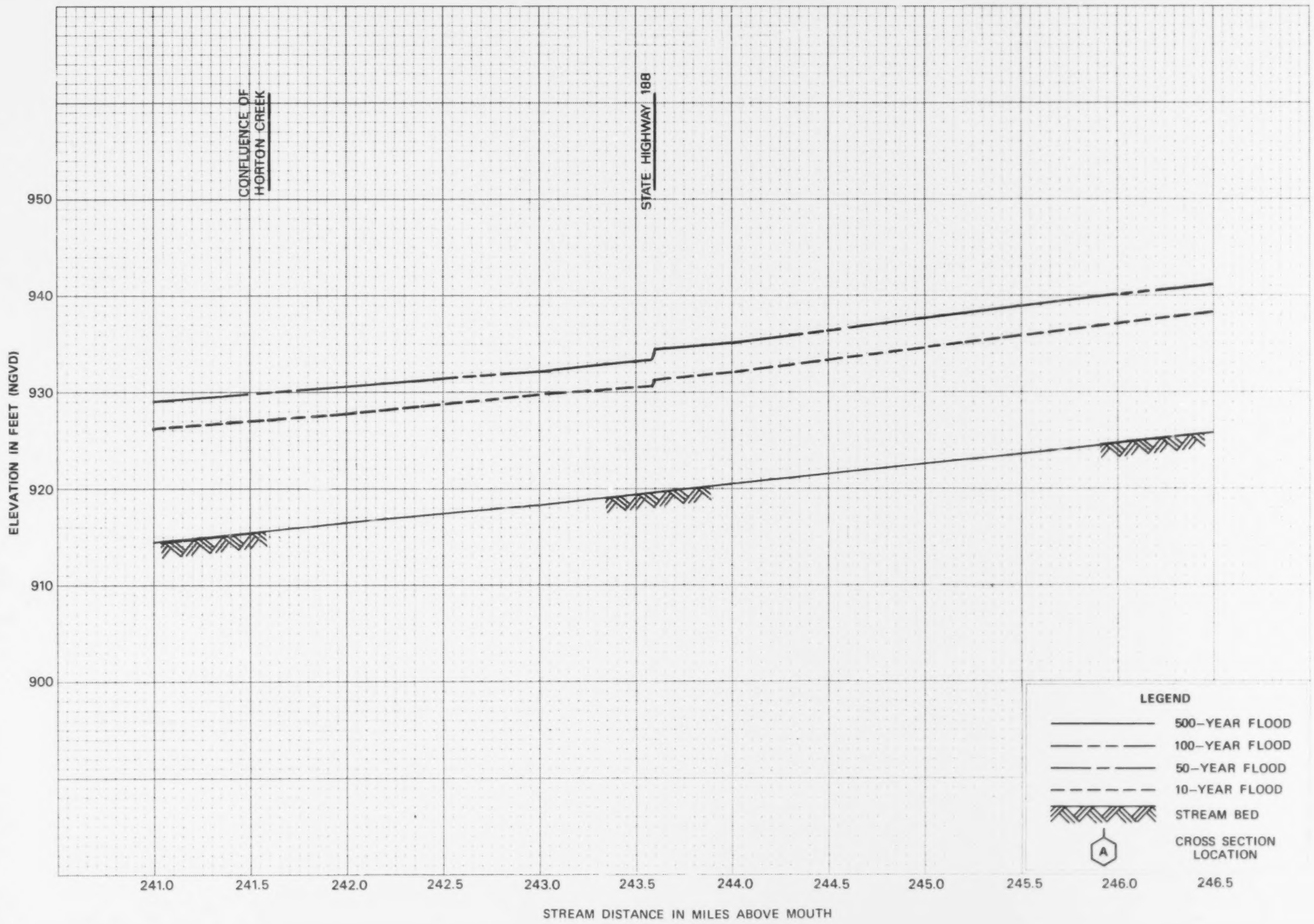
FLOOD PROFILES

CEDAR RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BREMER COUNTY, IA
AND INCORPORATED AREAS

04P



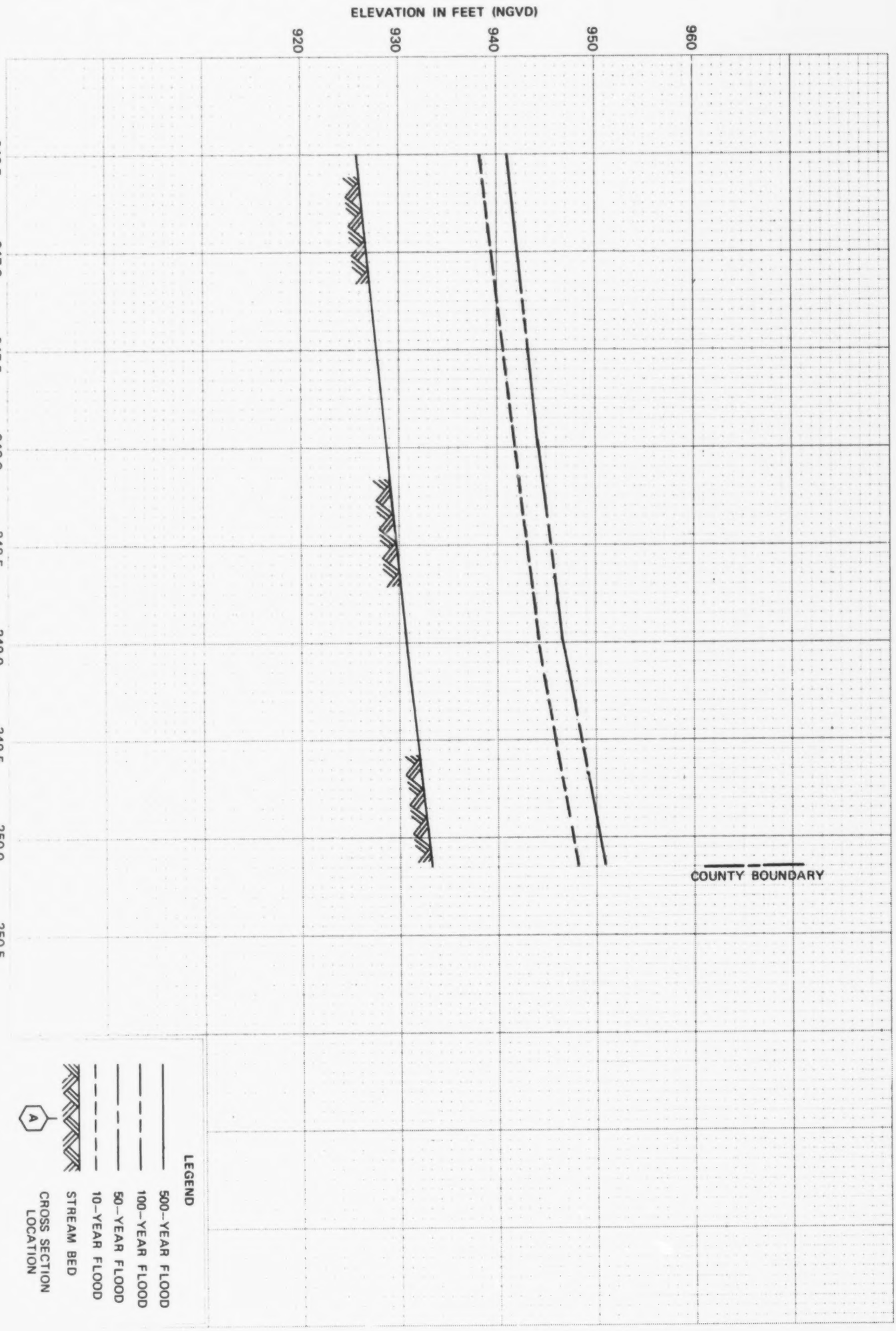
FLOOD PROFILES

CEDAR RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

BREMER COUNTY, IA AND INCORPORATED AREAS

05P



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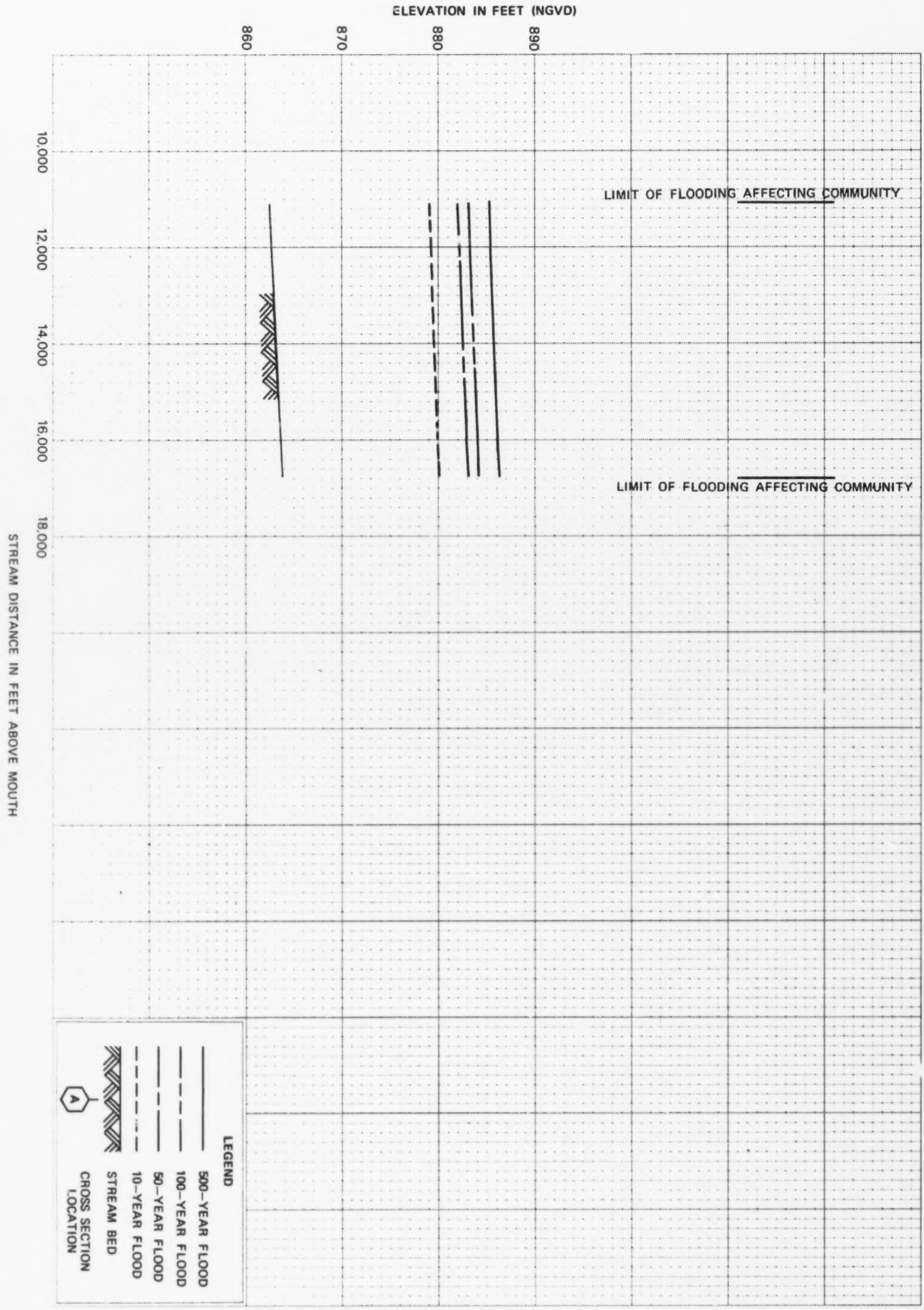

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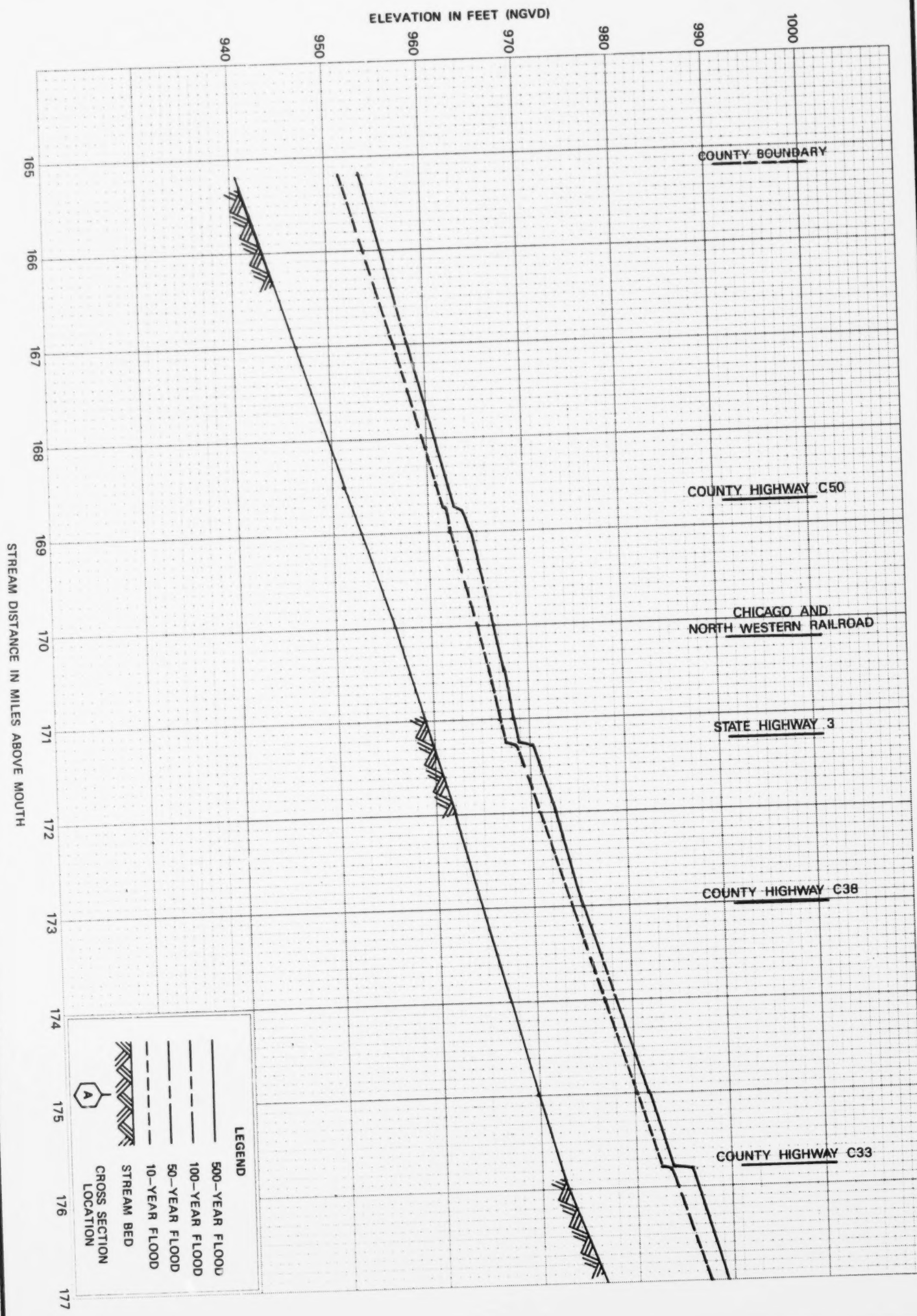
07P	FEDERAL EMERGENCY MANAGEMENT AGENCY **BREMER COUNTY, IA AND INCORPORATED AREAS**	**FLOOD PROFILES** **WEST FORK CEDAR RIVER**



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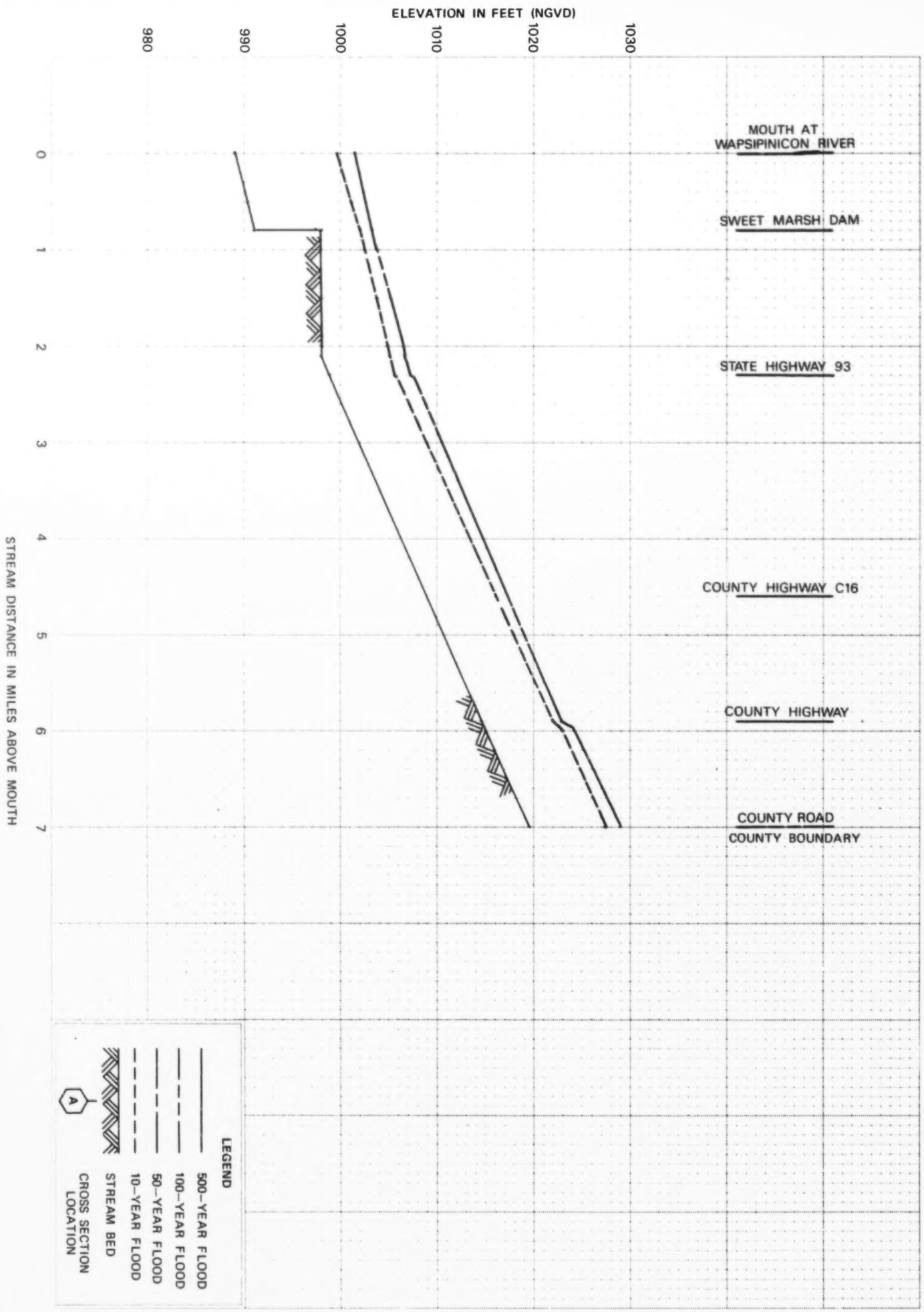


32A

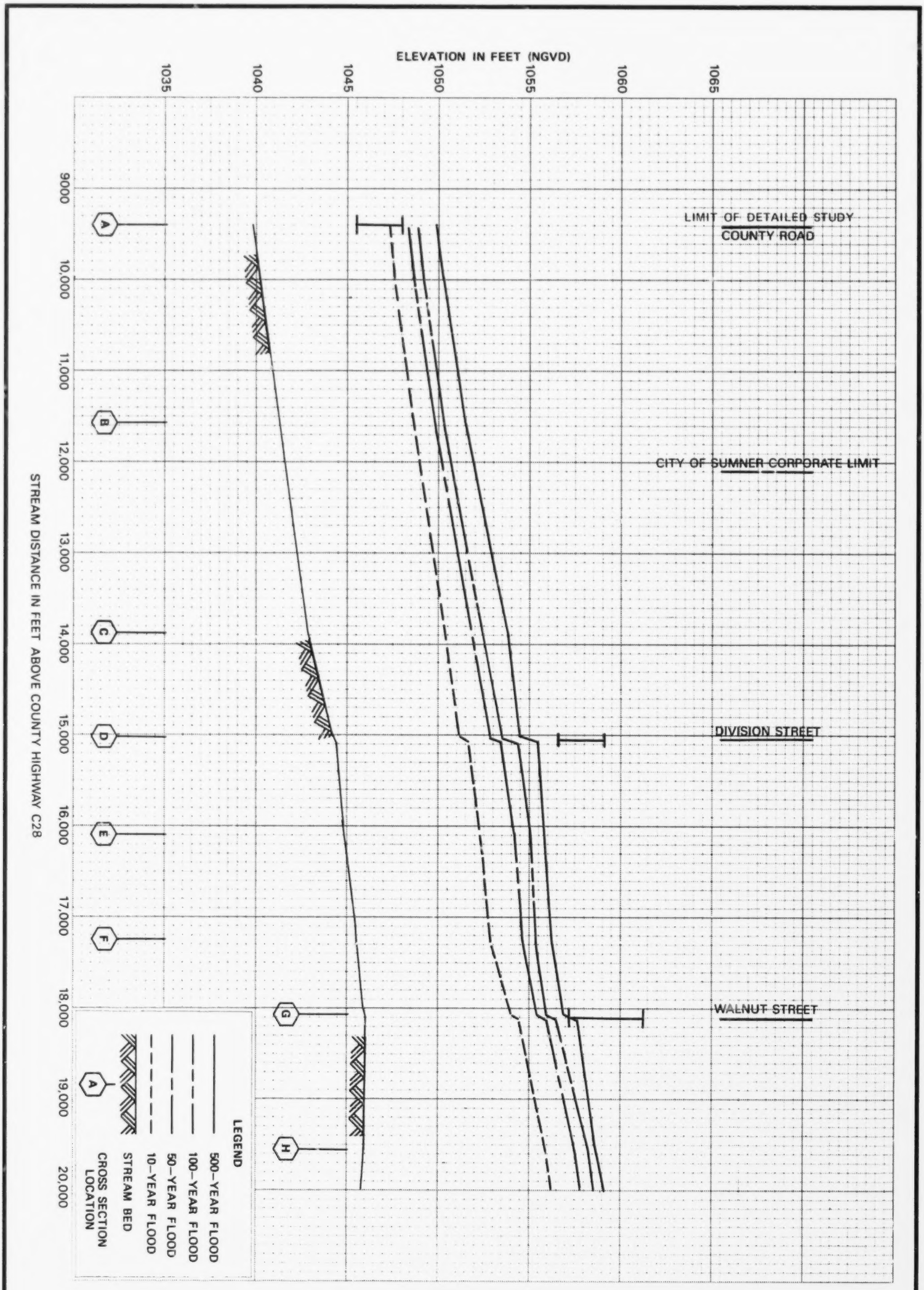
10P

FEDERAL EMERGENCY MANAGEMENT AGENCY

BREMER COUNTY, IA AND INCORPORATED AREAS

FLOOD PROFILES

EAST FORK WAPSIPINICON RIVER



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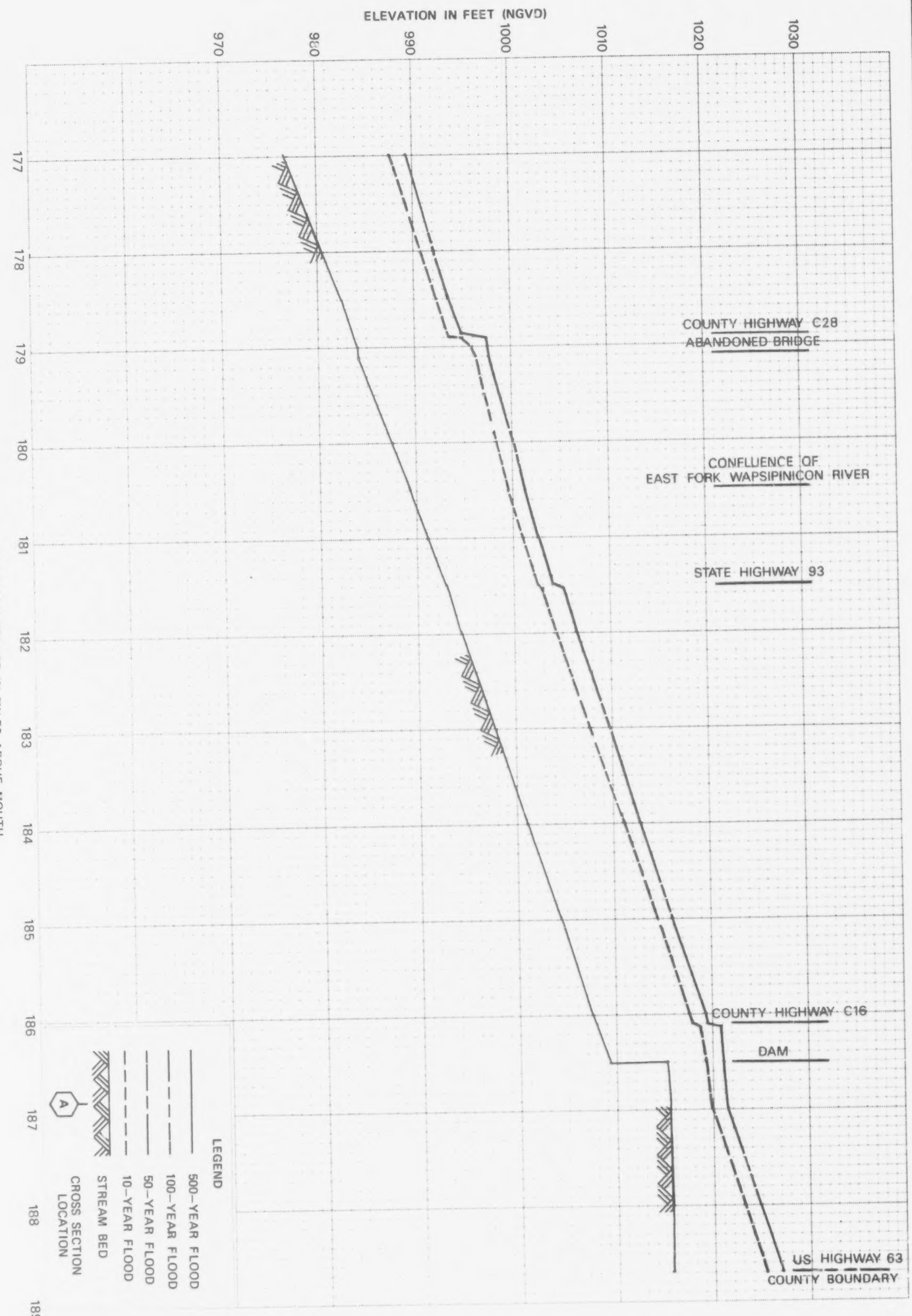
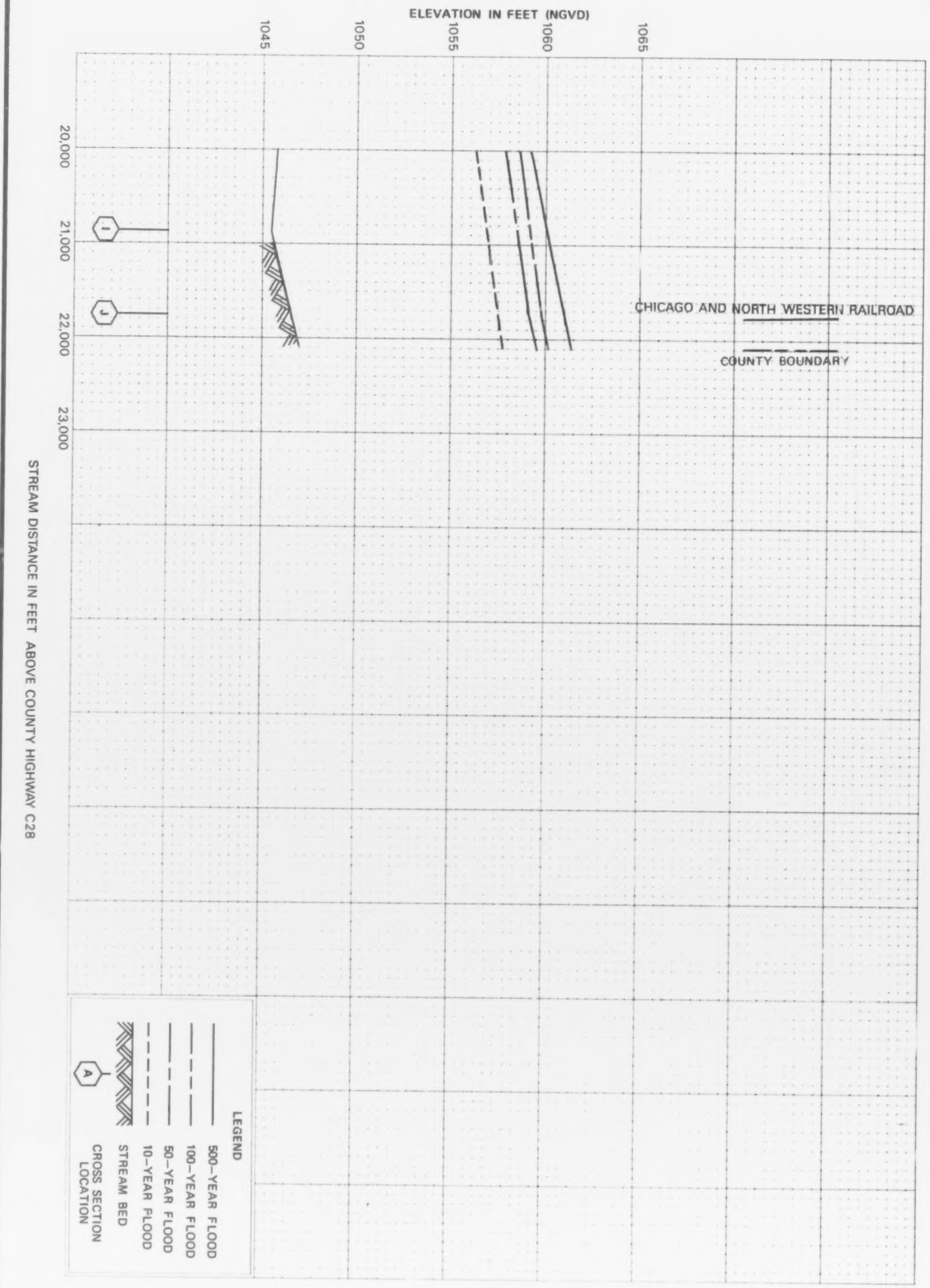
11P	FEDERAL EMERGENCY MANAGEMENT AGENCY BREMER COUNTY, IA AND INCORPORATED AREAS	FLOOD PROFILES LITTLE WAPSIPINICON RIVER



33A

09P	FEDERAL EMERGENCY MANAGEMENT AGENCY BREMER COUNTY, IA AND INCORPORATED AREAS	FLOOD PROFILES WAPSIPINICON RIVER



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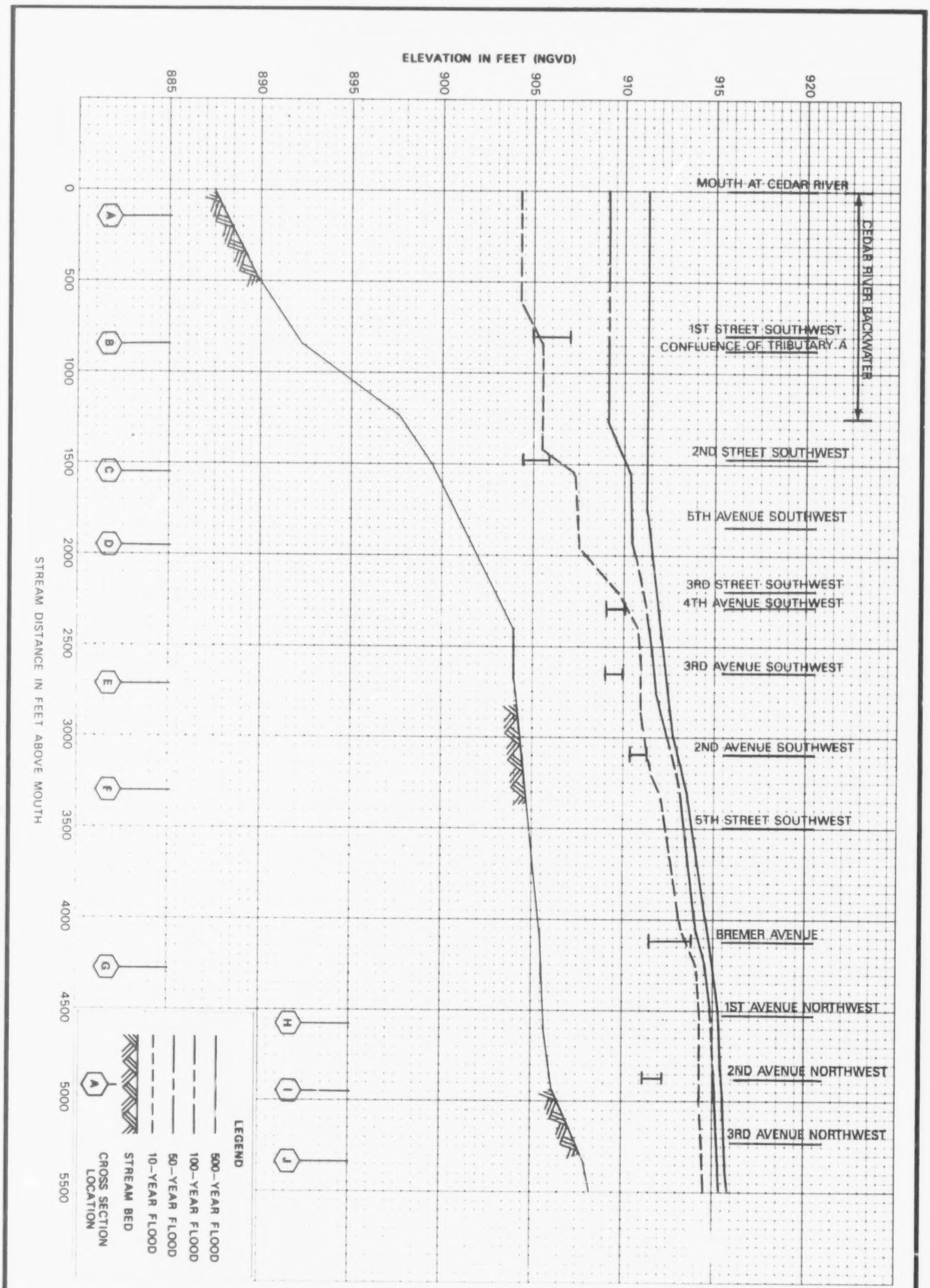
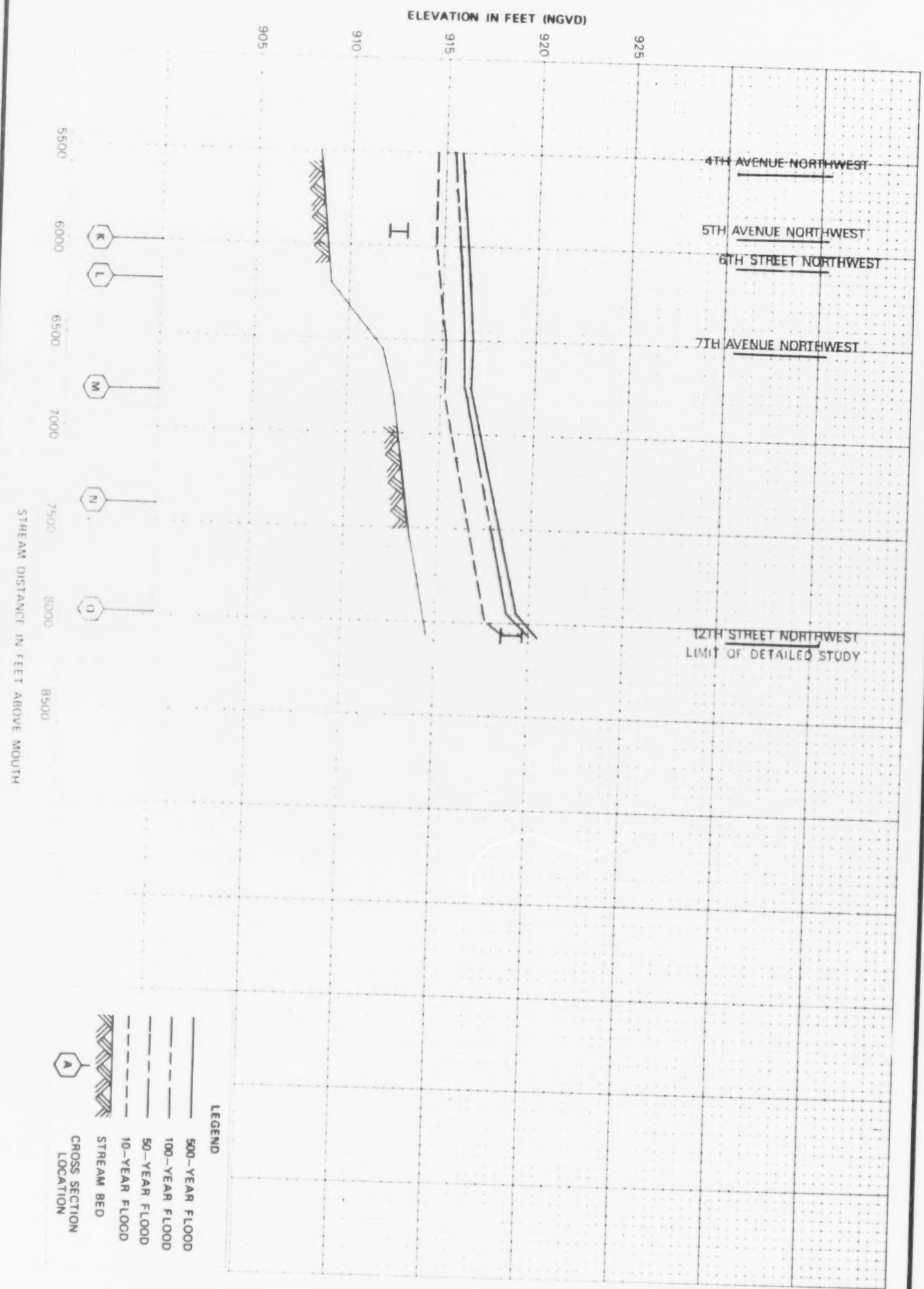
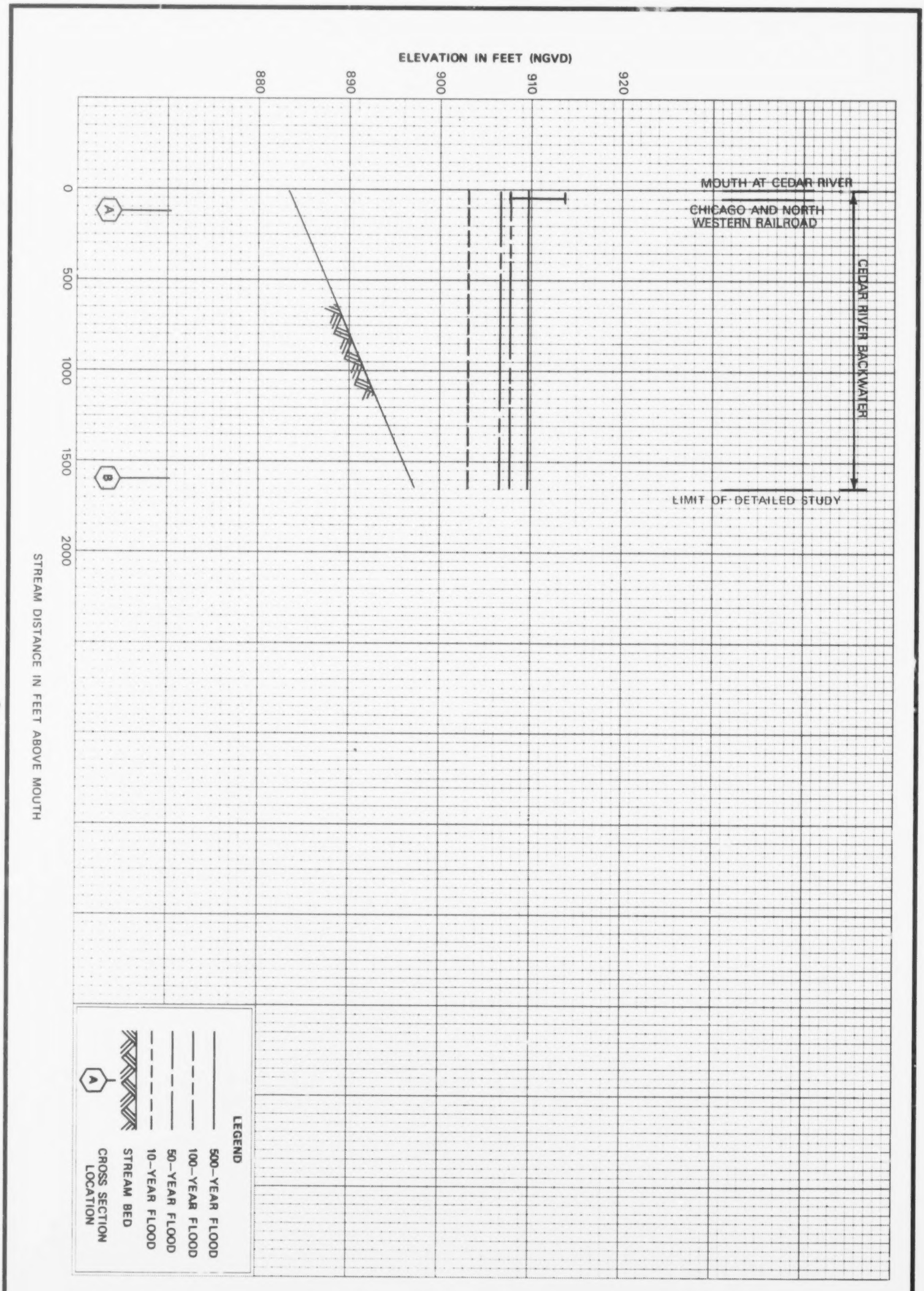
12P	FEDERAL EMERGENCY MANAGEMENT AGENCY BREMER COUNTY, IA AND INCORPORATED AREAS	FLOOD PROFILES LITTLE WAPSIPINICON RIVER



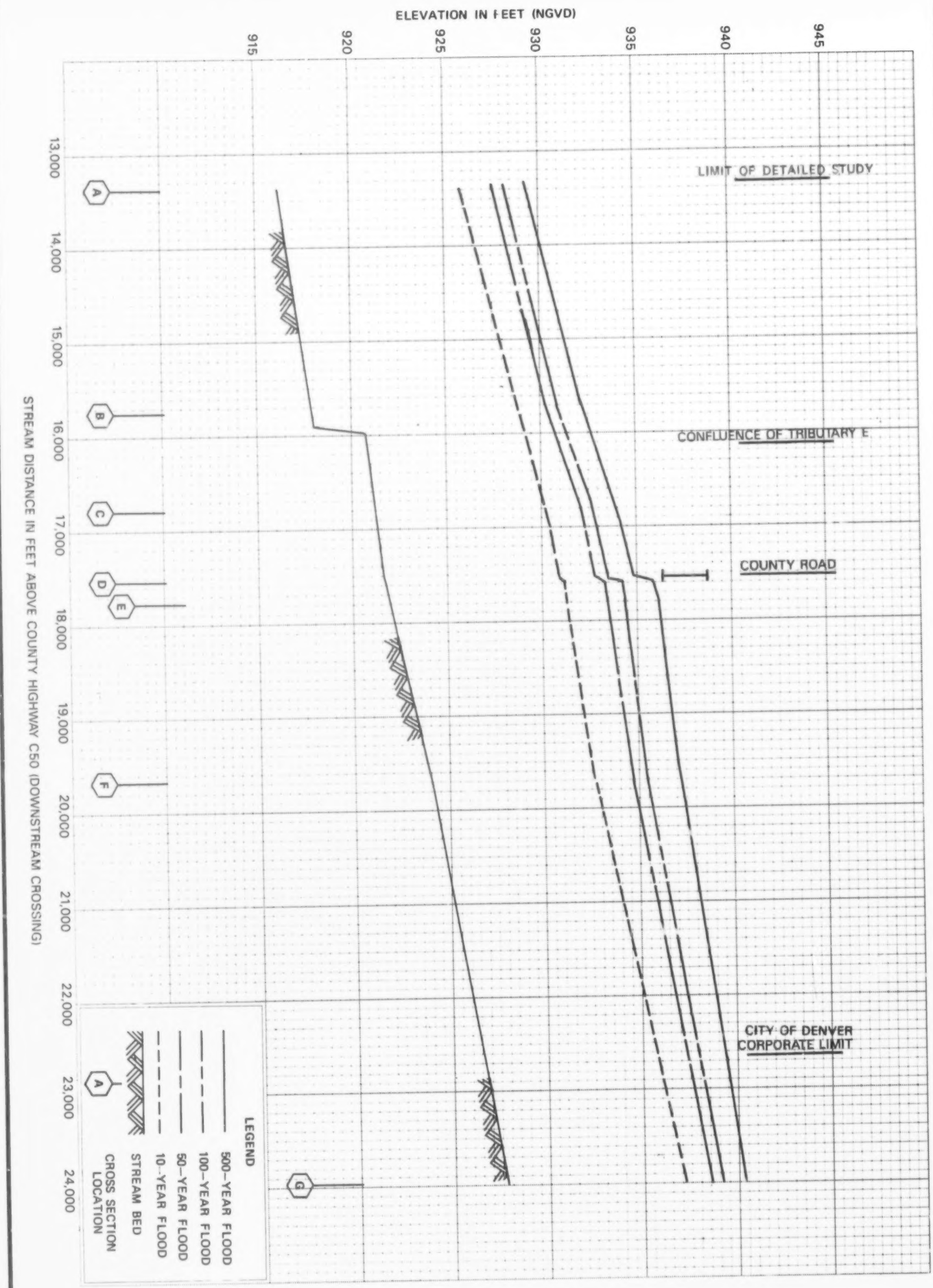
13P	FEDERAL EMERGENCY MANAGEMENT AGENCY BREMER COUNTY, IA AND INCORPORATED AREAS	FLOOD PROFILES DRY RUN CREEK



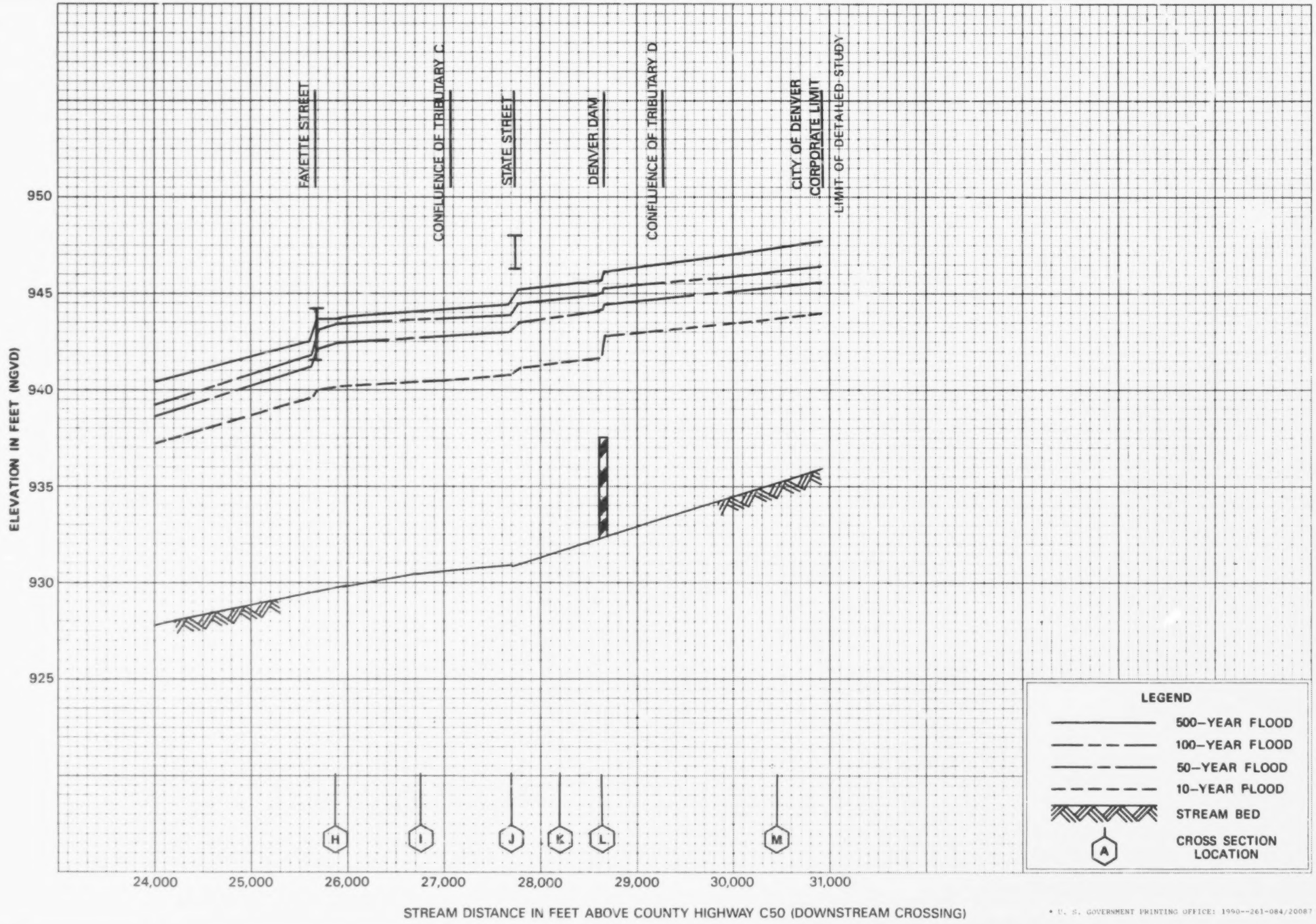
14P	FEDERAL EMERGENCY MANAGEMENT AGENCY BREMER COUNTY, IA AND INCORPORATED AREAS	FLOOD PROFILES DRY RUN CREEK



15P	FEDERAL EMERGENCY MANAGEMENT AGENCY BREMER COUNTY, IA AND INCORPORATED AREAS	FLOOD PROFILES UNNAMED CREEK



16P	FEDERAL EMERGENCY MANAGEMENT AGENCY **BREMER COUNTY, IA AND INCORPORATED AREAS**	**FLOOD PROFILES** **QUARTER SECTION RUN**



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FLOOD PROFILES

QUARTER SECTION RUN

FEDERAL EMERGENCY MANAGEMENT AGENCY

BREMER COUNTY, IA AND INCORPORATED AREAS

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